Freeform Search

Database:
- US Pre-Grant Publication Full-Text Database
- **US Patents Full-Text Database**
- US OCR Full-Text Database
- EPO Abstracts Database
- JPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins

Term: ((single$ near2 vis$) with sens$)

Display: 10 **Documents in Display Format:** TI **Starting with Number** 1

Generate: ○ **Hit List** ◉ **Hit Count** ○ **Side by Side** ○ **Image**

Search | Clear | Interrupt

Search History

DATE: Monday, October 22, 2007 Purge Queries | Printable Copy | Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L35	((single$ near2 vis$) with sens$)	6	L35
L34	(single$ adj vis$ adj2 sens$)	0	L34
L33	(driv$ or passenger$ or occupant$) and(single$ adj vis$ adj2 sens$)	0	L33
L32	(driv$ or passenger$ or occupant$) same(single$ adj vis$ adj2 sens$)	0	L32
L31	((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$)) and (single$ with vis$ with sens$)	4	L31
L30	((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$)) and (single$ adj vis$ adj sens$)	0	L30
L29	((sens$ with (position$ or coordinat$)) with (driv$ or passenger or occupant$)) and (single$ adj vis$ adj sens$)	0	L29
L28	L27 and (single$ adj vis$ adj sens$)	0	L28
L27	l23 or l24 or l25 or l26	39	L27
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
	(5479173 | 5642238 | 6037860 | 6580973 | 6499025 | 6492935 | 5983161 | 20020024713 | 6278918 | 6151065 | 6405132 | 6222447 | 6487481 | 4035764 |		

L26	3964302 | 6498620 | 20040145457 | 5646612 | 6587760 | 5091726 | 6198998 | 6411202 | 5699448 | 5475494)![PN]	24	L26
L25	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[PN]	8	L25
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L24	l15	8	L24
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L23	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[URPN]	7	L23
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L22	L20 and (single$ with (vision$ or visual$) with sens$)	0	L22
L21	L20 and (single$ adj vision$ adj sens$)	0	L21
L20	L19 not L15	26	L20
L19	L18 and 701/$.ccls.	26	L19
L18	L17 and safe$.clm.	111	L18
L17	L14 and ((sens$ with (position$ or coordinat$)) with (driv$ or passenger or occupant$))	944	L17
L16	L1 and ((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$))	1521	L16
L15	L14 and (single$ with (vision$ or visual$) with sens$)	8	L15
L14	L1 or L2	26501	L14
L13	L3 and (single$ with (vision$ or visual$) with sens$)	0	L13
	DB=PGPB; THES=ASSIGNEE; PLUR=YES; OP=OR		
L12	L5 and hood$	0	L12
L11	L5 and cruis$	1	L11
L10	L5 and (camera$ same ((sens$ with coordinat$) same referenc$))	0	L10
L9	L5 and camera$	1	L9
L8	L5 and ((sens$ with coordinat$) same referenc$)	1	L8
L7	L5 and L3	0	L7
L6	L5 and L4	0	L6
L5	20020026274	1	L5
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L4	L3 and (collid$ or collision$)	7	L4
L3	L1 and ((sens$ with coordinat$) same referenc$)	25	L3
L2	sensor$.clm. and (vehicle or automobile or car$).clm. and control$.clm. and @ad<=20031222	20886	L2
L1	sensor$.clm. and (vehicle or automobile or car$).clm. and control$ and @ad<=20031222	26501	L1

END OF SEARCH HISTORY

Edit an existing query or compose a new query in the Search Query Display.

Select a search number (#) to:

- Add a query to the Search Query Display
- Combine search queries using AND, OR, or NOT
- Delete a search
- Run a search

Mon, 22 Oct 2007, 9:58:29 AM EST

Search Query Display

10/709569

Run Search Reset

Recent Search Queries

#1 ((sens* <sentence> (position* <or> coordinat*)) <sentence> (driv* <or> passenger* <or> occupant*)) <and> (single* <sentence> vis* <sentence> sens*) <in> pdfdata

Set Date Search History

Indexed by Inspec

Results for "((sens* <sentence> (position* <or> coordinat*)) <sentence> (driv* <or> passe..." e-mail
Your search matched **8** of **1675827** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

» Search Options

View Session History

New Search

Modify Search

((sens* <sentence> (position* <or> coordinat*)) <sentence> (driv* <or> passenger* <o Search

Check to search only within this results set

Display Format: Citation Citation & Abstract

» Key

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

view selected items Select All Deselect All

1. **Image processing and analysis in multisensory systems**
Ikonomopoulos, A.; Ghani, N.; Doemens, G.; Kutzer, E.; Roth, N.;
Circuits and Systems, IEEE Transactions on
Volume 34, Issue 11, Nov 1987 Page(s):1417 - 1431
Summary: An overview of trends on image processing and analysis in visual a sensors introduces the presentation of two multisensory systems in industrial a weakness of computer vision to solve object perception and localization iss.....
AbstractPlus | Full Text: PDF(2800 KB) **IEEE JNL**
Rights and Permissions

2. **Real-time part position sensing**
Gordon, S.J.; Seering, W.P.;
Pattern Analysis and Machine Intelligence, IEEE Transactions on
Volume 10, Issue 3, May 1988 Page(s):374 - 386
Digital Object Identifier 10.1109/34.3901
Summary: A light-stripe vision system is used to measure the location of polyh parts from a single frame of video camera output. The geometric conditions wh location of the feature when the light plane intersects three of the featur.....
AbstractPlus | Full Text: PDF(1068 KB) **IEEE JNL**
Rights and Permissions

3. **Multisensor integration and fusion in intelligent systems**
Luo, R.C.; Kay, M.G.;
Systems, Man and Cybernetics, IEEE Transactions on
Volume 19, Issue 5, Sept.-Oct. 1989 Page(s):901 - 931
Digital Object Identifier 10.1109/21.44007
Summary: The issues involved in integrating multiple sensors into the operatio presented in the context of the type of information these sensors can uniquely p is provided of the variety of approaches to the problem of multise.....
AbstractPlus | Full Text: PDF(3184 KB) **IEEE JNL**
Rights and Permissions

4. **Neuromorphic analog VLSI sensor for visual tracking: circuits and applica**
Indiveri, G.;
Circuits and Systems II: Analog and Digital Signal Processing, IEEE Transactio
Circuits and Systems II: Express Briefs, IEEE Transactions on]
Volume 46, Issue 11, Nov. 1999 Page(s):1337 - 1347
Digital Object Identifier 10.1109/82.803473
Summary: This paper presents a one-dimensional visual sensor, implemented

chip using analog neuromorphic circuits, for selectively detecting and tracking t feature with the highest spatial contrast present in the visual scen.....

AbstractPlus | References | Full Text: PDF(784 KB) **IEEE JNL**
Rights and Permissions

☐ **5. Protein-based photocell for high-speed motion detection**
Wei Wei Wang; Knopf, G.K.; Bassi, A.S.;
Control Applications, 2005. CCA 2005. Proceedings of 2005 IEEE Conference
28-31 Aug. 2005 Page(s):731 - 736
Digital Object Identifier 10.1109/CCA.2005.1507215
Summary: Not available.....

AbstractPlus | Full Text: PDF(257 KB) **IEEE CNF**
Rights and Permissions

☐ **6. Development of a Patrol Robot**
Zeng Dehuai; Xie Cunxi;
Industrial Electronics, 2005. ISIE 2005. Proceedings of the IEEE International S
Volume 4, June 20-23, 2005 Page(s):1757 - 1762
Summary: Not available.....

AbstractPlus | Full Text: PDF(242 KB) **IEEE CNF**
Rights and Permissions

☐ **7. High performance sensor fusion architecture for vision-based occupant d**
Owechko, Y.; Srinivasa, N.; Medasani, S.; Boscolo, R.;
Intelligent Transportation Systems, 2003. Proceedings. 2003 IEEE
Volume 2, 12-15 Oct. 2003 Page(s):1128 - 1133 vol.2
Summary: We describe a fast and reliable vision system for detecting and reco occupants in automobiles. The main advantage of our system is its high accura of fusion module, which combines the results of multiple classifiers operating ..

AbstractPlus | Full Text: PDF(435 KB) **IEEE CNF**
Rights and Permissions

☐ **8. A neural network based torque controller for collision-free navigation of m**
Yang, S.X.; Tiemin Hu; Xiaobu Yuan; Liu, P.X.; Max Meng;
Robotics and Automation, 2003. Proceedings. ICRA '03. IEEE International Co
Volume 1, 14-19 Sept. 2003 Page(s):13 - 18 vol.1
Summary: In this paper, a neural network based torque controller is proposed collision-free navigation of nonholonomic mobile robots. A torque resulted from incorporated in the control design based on the artificial potential te.....

AbstractPlus | Full Text: PDF(434 KB) **IEEE CNF**
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Refine Search

Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Search Results -

Terms	Documents
L27 and (single$ adj vis$ adj sens$)	0

Database: US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: 10/707569

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Monday, October 22, 2007 Purge Queries Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
	L27 and (single$ adj vis$ adj sens$)	0	
	l23 or l24 or l25 or l26	39	
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
	(5479173 | 5642238 | 6037860 | 6580973 | 6499025 | 6492935 | 5983161 | 20020024713 | 6278918 | 6151065 | 6405132 | 6222447 | 6487481 | 4035764 | 3964302 | 6498620 | 20040145457 | 5646612 | 6587760 | 5091726 | 6198998 | 6411202 | 5699448 | 5475494)![PN]	24	
	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[PN]	8	
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES;		

OP=OR			
L24	l15	8	L24
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L23	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[URPN]	7	L23
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L22	L20 and (single$ with (vision$ or visual$) with sens$)	0	L22
L21	L20 and (single$ adj vision$ adj sens$)	0	L21
L20	L19 not L15	26	L20
L19	L18 and 701/$.ccls.	26	L19
L18	L17 and safe$.clm.	111	L18
L17	L14 and ((sens$ with (position$ or coordinat$)) with (driv$ or passenger or occupant$))	944	L17
L16	L1 and ((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$))	1521	L16
L15	L14 and (single$ with (vision$ or visual$) with sens$)	8	L15
L14	L1 or L2	26501	L14
L13	L3 and (single$ with (vision$ or visual$) with sens$)	0	L13
	DB=PGPB; THES=ASSIGNEE; PLUR=YES; OP=OR		
L12	L5 and hood$	0	L12
L11	L5 and cruis$	1	L11
L10	L5 and (camera$ same ((sens$ with coordinat$) same referenc$))	0	L10
L9	L5 and camera$	1	L9
L8	L5 and ((sens$ with coordinat$) same referenc$)	1	L8
L7	L5 and L3	0	L7
L6	L5 and L4	0	L6
L5	20020026274	1	L5
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L4	L3 and (collid$ or collision$)	7	L4
L3	L1 and ((sens$ with coordinat$) same referenc$)	25	L3
L2	sensor$.clm. and (vehicle or automobile or car$).clm. and control$.clm. and @ad<=20031222	20886	L2
L1	sensor$.clm. and (vehicle or automobile or car$).clm. and control$ and @ad<=20031222	26501	L1

END OF SEARCH HISTORY

L31: Entry 1 of 4 File: USPT May 22, 1990

US-PAT-NO: 4926682
DOCUMENT-IDENTIFIER: US 4926682 A

TITLE: Viscosity sensor

DATE-ISSUED: May 22, 1990

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Holm-Kennedy; James W.	Honolulu	HI		
McArthur; Scot P.	Honolulu	HI		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
The Research Corporation of the University of Hawaii	Honolulu	HI			02

APPL-NO: 07/201887 [PALM]
DATE FILED: June 3, 1988

INT-CL-ISSUED: [05] G01N 11/00

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPP	G01 N 11/00	20060101

US-CL-ISSUED: 73/54
US-CL-CURRENT: 73/54.01

FIELD-OF-CLASSIFICATION-SEARCH: 73/54, 324/61R, 361/280, 361/281
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	2772393	November 1956	Davis	331/65
☐	3278919	October 1966	Fleming	307/308
☐	3500366	March 1970	Chesney et al.	331/65

L31: Entry 2 of 4 File: USPT Jan 31, 1984

US-PAT-NO: 4429217
DOCUMENT-IDENTIFIER: US 4429217 A

TITLE: Verifying insertion system and apparatus

DATE-ISSUED: January 31, 1984

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hill; James E.	Prospect Heights	IL		
Dahlstrom; Baesley I.	Des Plaines	IL		
Fisher; Robert D.	Melrose Park	IL		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Dynetics Engineering Corp.	Wheeling	IL			02

APPL-NO: 06/048767 [PALM]
DATE FILED: June 15, 1979

PARENT-CASE:
RELATED APPLICATION This application is a division of copending application Ser. No. 832,001 filed Sept. 9, 1977, now U.S. Pat. No. 4,194,685, issued Mar. 25, 1980, which in turn, is a continuation-in-part of application Ser. No. 768,446 filed Feb. 14, 1977 entitled Credit Card Carriers, Apparatus and Methods, which in turn is a required divisional of application Ser. No. 615,112 filed Sept. 19, 1975 entitled Credit Card Carriers and Methods of Manufacture, now U.S. Pat. No. 4,034,210 issued July 5, 1977. The embossed character reader head employed in the apparatus of these applications is the subject of copending application Ser. No. 723,215 filed Sept. 14, 1976 entitled Embossed Character Reader and assigned to same assignee of the instant and other applications.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
CA	261445	September 17, 1976
GB	38812/76	September 20, 1976

INT-CL-ISSUED: [03] G06K 5/00, G06K 7/08, B65B 11/48, B65H 39/00

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	B43 M 3/00	20060101
CIPS	B43 M 3/04	20060101

US-CL-ISSUED: 235/380; 53/206, 235/449, 270/52
US-CL-CURRENT: 235/380; 235/449, 270/52.13, 53/206

FIELD-OF-CLASSIFICATION-SEARCH: 53/31, 53/206, 53/266, 23/253R, 235/449, 235/454, 235/491, 360/53, 270/52
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL | Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
▩	3371466	March 1968	Klopfenstein	53/206
▩	3484097	December 1969	Jory	270/52
▩	3508702	April 1970	Kaiser	
▩	3704015	November 1972	Holovka	
▩	3800124	March 1974	Walsh	235/449
▩	3804226	April 1974	Ellis	
▩	3819173	June 1974	Anderson	
▩	3848112	November 1974	Weichsel baum	235/449
▩	3870867	March 1975	Hamisch	235/491
▩	3891492	June 1975	Watson	235/454
▩	3896606	July 1975	Utsumi	53/266
▩	3899165	August 1975	Abram	
▩	3899381	August 1975	O'Brien	
▩	3909203	September 1975	Young	23/253R
▩	3941308	March 1976	DiGirolomo	53/31
▩	3951251	April 1976	Zaccagnino	
▩	3961781	June 1976	Funk	
▩	3965644	June 1976	Stocker	
▩	3982102	September 1976	Cidade	
▩	3999700	December 1976	Chalmers	
▩	4003183	January 1977	Helm	53/31
▩	4027141	May 1977	Dubbe	360/53
▩	4091268	May 1978	Jarleton	

ART-UNIT: 235

PRIMARY-EXAMINER: Kilgore; Robert M.

ATTY-AGENT-FIRM: Dulin; Jacques M.

ABSTRACT:

Apparatus and method of verification of credit cards, including sensing information thereon and comparing said information with information on a specially designed pre-printed carrier, followed by insertion of one or more cards in the matching carrier as required, folding and stacking card-inserted carriers in a manner ready for subsequent insertion into mailing envelopes. Sensing, input, comparison logic, and timed command circuitry for coordination of operation includes a pause mode of card advance and may optionally include a multiple card search mode to find matching cards when card sequence is improper.

26 Claims, 43 Drawing figures

Refine Search

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Database: US Pre-Grant Publication Full-Text Database; US Patents Full-Text Database; US OCR Full-Text Database; EPO Abstracts Database; JPO Abstracts Database; Derwent World Patents Index; IBM Technical Disclosure Bulletins

Search: 10/707569

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	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
	(driv$ or passenger$ or occupant$) and(single$ adj vis$ adj2 sens$)	0	
	(driv$ or passenger$ or occupant$) same(single$ adj vis$ adj2 sens$)	0	
	((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$)) and (single$ with vis$ with sens$)	4	
	((sens$ with (position$ or coordinat$)) same (driv$ or passenger or occupant$)) and (single$ adj vis$ adj sens$)	0	
	((sens$ with (position$ or coordinat$)) with (driv$ or passenger or occupant$)) and (single$ adj vis$ adj sens$)	0	
	L27 and (single$ adj vis$ adj sens$)	0	
	l23 or l24 or l25 or l26	39	

	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L26	(5479173 | 5642238 | 6037860 | 6580973 | 6499025 | 6492935 | 5983161 | 20020024713 | 6278918 | 6151065 | 6405132 | 6222447 | 6487481 | 4035764 | 3964302 | 6498620 | 20040145457 | 5646612 | 6587760 | 5091726 | 6198998 | 6411202 | 5699448 | 5475494)![PN]	24	L26
L25	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[PN]	8	L25
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L24	115	8	L24
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L23	("20050137774"| "20050017857"| "20030179084"| "20050073396"| "4307374"| "6862537"| "7158015"| "6958683")[URPN]	7	L23
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L22	L20 and (single$ with (vision$ or visual$) with sens$)	0	L22
L21	L20 and (single$ adj vision$ adj sens$)	0	L21
L20	L19 not L15	26	L20
L19	L18 and 701/$.ccls.	26	L19
L18	L17 and safe$.clm.	111	L18
L17	L14 and ((sens$ with (position$ or coordinat$)) with (driv$ or passenger or occupant$))	944	L17
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L13	L3 and (single$ with (vision$ or visual$) with sens$)	0	L13
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L11	L5 and cruis$	1	L11
L10	L5 and (camera$ same ((sens$ with coordinat$) same referenc$))	0	L10
L9	L5 and camera$	1	L9
L8	L5 and ((sens$ with coordinat$) same referenc$)	1	L8
L7	L5 and L3	0	L7
L6	L5 and L4	0	L6
L5	20020026274	1	L5
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L4	L3 and (collid$ or collision$)	7	L4
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L2	sensor$.clm. and (vehicle or automobile or car$).clm. and control$.clm. and @ad<=20031222	20886	L2
L1	sensor$.clm. and (vehicle or automobile or car$).clm. and control$ and @ad<=20031222	26501	L1

DETECTING AND MINIMIZING POTENTIAL IMPACTS FROM VALVE HALL FIRES

R.L.P. Custer
Worcester Polytechnic Institute

D.M. Demarest
Consultant

P.H. Dobson
Factory Mutual Research Corp.

J.A. Donahue, Member IEEE
New England Power Service Co.

Abstract - This paper discusses methods for detecting and minimizing potential impacts from valve hall fires. Comparisons are made between commercially available valve hall fire detection and suppression systems. The fire detection and suppression system installed at the Sandy Pond HVDC Converter Terminal is described.

Keywords - Thyristor valve, HVDC, fire, safety, quadravalve wall bushing, oil fire, availability, unavailability

INTRODUCTION

Modern HVDC systems have very stringent reliability and availability requirements, usually with severe economic penalties to the manufacturer and the owner if high levels of availability and reliability are not maintained. A failure of any equipment located in the valve hall which results in a fire typically requires an extended outage to repair or replace the failed component and also decontaminate other equipment located in the valve hall. The duration of the outage is usually a function of the severity of actual equipment failure and the time needed to decontaminate other equipment. In some cases the decontamination time may exceed the equipment repair or replacement time.

A recent informal survey of HVDC systems throughout the world identified nine instances of equipment failure which initiated a fire inside the valve hall. Of these nine equipment failures two were related to wall bushing failures and seven were related to valve component failures or installation errors. Recently there have been two catastrophic fires (Itaipu and Rihand) in valve halls which have seriously impacted availability of the associated HVDC systems.

There are many ways in which valve component failures may result in initiation of a fire. Component and component connection failure within a valve is of major concern because the power through or across the defect is equivalent to that from a near constant current source. To date this type of partial failure within a single valve has defied detection by power circuit means external to the valve. The defect or fault may transform itself into an arc which may grow and become destructive to surrounding components due to heat radiation, magnetic distortion of the arc, and ignition of adjacent flammable materials. Contaminated and wet insulation due to cooling system leaks and roof leaks, foreign materials, high resistivity connections, and overloads due to defective relay circuits are other types of valve component failures which may initiate a fire and may not be immediately detected.

Independent of the cooling medium which the valve utilizes, there are a variety of ways valve component failures may transform themselves into arcing faults which may go undetected for an extended period of time. Therefore it is important to understand the material properties of components throughout the valve. A total of over 60,000 pounds of flammable materials are present in some bipolar HVDC converter terminal valve halls. The flammability of these materials is of major importance when trying to minimize the impact of a valve fire. Tests are typically used to quantify the hazard of flammable plastics. A plastic may rate "self-extinguishing" by one test, yet ignite and burn rapidly by another test. For example, a material tested in the horizontal position, ignited at one end by a bunsen burner, may rate "self-extinguishing". The same material, arranged in a vertical position, ignited with a bunsen burner at the bottom may result in ignition and rapid flame spread even after the original heat source is removed. Test methods are available which allow heat release rate properties to be quantified. The Factory Mutual Research Corporation (FMRC) Small Scale Flammability Apparatus and Cone Calorimeter are examples of such tests (1) (2).

The Sandy Pond Converter Terminal thyristor valves contain large quantities of flammable plastics, thus it was necessary to investigate various methods for detecting and minimizing impacts of valve hall fires and install a more sensitive fire detection system and a fire suppression system.

DETECTING VALVE HALL FIRES

If the valve hall fire involves a large release of insulating oil, as in a wall bushing failure, traditional ceiling mounted and return air duct smoke detectors can provide adequate fire detection. In addition, many of the electrical conditions associated with such a failure would be quickly detected by protective relaying and

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